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Exploring Engineering Club

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NEBRASKA HONORS PROGRAM
CLC EXPANDED LEARNING OPPORTUNITY CLUBS
INFORMATION SHEET

Name of Club: Exploring Engineering

Age/Grade Level: 3rd-5th Grade

Ideal Number of Attendees: 10-12

Goal of the Club:

Our goal is to provide an introduction to a variety of engineering problems and pique the students' interest in engineering by accompanying the information with hands-on problem solving activities mainly related to structural engineering. The activities will often be done in teams which will teach good teamwork skills, as well as problem solving and critical thinking. Even if the student is not necessarily interested in engineering, doing these club activities with everyday objects will be fun challenges that will help them learn to be resourceful and learn how the world works.

Content Areas:

- ☐ Arts (Visual, Music, Theater & Performance)
- ☐ Literacy
- X STEM (Science, Technology, Engineering & Math)
- ☐ Social Studies
- ☐ Wellness (Physical Education, Health, Nutrition & Character Education)

Outputs or final products:

There is not a set final product, but some days the kids will be able to take home their projects if they want. Their last project is to create a bridge out of popsicle sticks and glue, and this will be the final product created using all the skills they have learned thus far.

Introducing your Club/Activities:

We began each club with a short presentation about a different type of engineering or skills engineers need. Then we instructed them to form teams and gave instructions for the day's engineering challenge. This lesson plan is for an 8 week club.

General Directions:

We often gave them a limited number of supplies to begin with in order to simulate real life situations where there is a limited budget for a project. However, if they have used all their resources wisely and are working well together then we will "award" them more. Additionally, the club leaders should walk around during the time and ensure that students are going in the right direction and giving them advice about how to succeed so they do not become frustrated.

Tips/Tricks:

A great way to keep the introduction presentations engaging is to ask the kids what they think a certain type of engineer does and what they would work on.

We learned that groups of 2-3 students worked best because each student could participate hands-on and reduced the risk of kids becoming bored due to one student taking over.

We began by having the activities being a challenge and winning prizes, however this got too competitive and those who did not win a prize became sad. After this, we decided not to announce clear winners, although we still told them it was a competition.

Have a list of team building/classroom games such as detective, the human knot challenge, heads-up seven-up, and Simon Says ready so that you have extra things to do if the activity goes quicker than anticipated and the kids are getting rowdy.

LESSON PLAN WORKSHEET

Lesson Activity
Name:

Bridging Into Engineering

Length of Activity:

40 min.

Supplies:

a 16 oz bag of marshmallows, box of toothpicks

Directions:

Begin with introductions, a name game, and a short presentation to introduce the concept of engineering. Today's activity is building a one-foot bridge with toothpicks and marshmallows. Each team will have an even amount of materials. The teams will have to make a table that will have to stretch from one table to another. Bridges will be "rated" based on physical appearance and structure.

Conclusion of the activity:

Most teams were able to construct a solid bridge that spanned a good distance. Repeatedly telling them that triangles are the strongest shape gave them a better idea of what their bridge would need to succeed.

Parts of activity that worked:

The kids said this was one of their favorite activities; it allowed for many creative solutions and required teamwork to get it done on time.

Parts of activity that did not work:

It began to get messy when the kids took apart some of their bridge and rebuilt it using the same marshmallows and toothpicks, as the table and their hands got very sticky. We solved this by allowing them to trade in old marshmallows.

LESSON PLAN WORKSHEET

Lesson Activity
Name:

The Tallest Tower

Length of Activity:

40 min.

Supplies:

24 pieces of paper, 2 packs of 100 index cards, a roll of painters tape

Directions:

Begin with a presentation introducing civil engineering. The challenge is to build the highest free-standing structure with 10-15 index cards and some tape. Students will have to work together to design a structure that is impressively tall, but also must be structurally sound (no falling over!). If time permits, teams will have to build the tallest tower using only three pieces of printer paper and tape.

Conclusion of the activity:

A majority of their final products looked extremely similar, as their minds must have all been thinking the same way at the same age. Their towers were also not very structurally sound, but they worked. The kids built a tower relatively quickly and then became bored, so we had to do the second half of this lesson plan as well, and we even had time to play a team game.

Parts of activity that worked:

The kids enjoyed creating a tall tower and trying to make theirs taller than the other teams.

Parts of activity that did not work:

The kids were not able to problem solve when completing this activity as much as we had envisioned, so we had to give them more paper and tape so they did not become frustrated and give up.

LESSON PLAN WORKSHEET

Lesson Activity Will it Float?

Name:

Length of Activity: 40 min.

Supplies: 1 roll of 75 sq ft aluminum foil, a bin to can put water in to test the boats in, 100 pennies, 12 pieces of paper, 6 crayons, paper towels

Directions:

Start with a short PowerPoint introducing chemical engineering. Today, teams will have to craft a boat using only tin foil and see which one can hold the most pennies without sinking or tipping. If time permits, students must find a way to make a floating boat out of printer paper and a crayon (hint: they'll need to color the entire paper to coat it in wax to get it to float).

Conclusion of the activity:

The kids enjoyed this activity, although some took a very practical route and made a boat that could float and others took a more creative approach and tried to make their boats look unique. Some boats were able to hold more than the 50 pennies we originally planned for.

Parts of activity that worked:

The students really enjoyed this activity, and all of them had unique designs. We let each student work individually on this, which worked well because then each one could have their own ideas about how to design their boat.

Parts of activity that did not work:

Several kids had done the challenge of getting a paper completely covered in crayon to float, and they shared the solution with others which made it less challenging. This activity also resulted in water getting all over the tables, especially when water would get inside the foil.

LESSON PLAN WORKSHEET

Lesson Activity

House of Straws

Name:

Length of Activity:

40 min.

Supplies:

A kit of reusable straws and connectors

Directions:

Begin with a presentation introducing mechanical engineering. The activity is to have teams design and build a house using the kit of straws. Encourage creativity by asking them questions about the purpose of different parts of their house.

Conclusion of the activity:

This activity resulted in a variety of structures for many different purposes. It was more design based than problem solving, which the students that were not as interested in engineering really enjoyed. Up until the end, this was one of our most successful days.

Parts of activity that worked:

The kids enjoyed working with one or two other students to bounce ideas off each other and work together to design the coolest house.

Parts of activity that did not work:

At one point at the very end, two groups suddenly both destroyed each other's houses. From this point on, we realized that we needed to tell the students that wrecking each other's work would not be tolerated.

LESSON PLAN WORKSHEET

Lesson Activity

Earthquake Engineering

Name:

Length of Activity:

40 min.

Supplies:

a kit of wooden blocks

Directions:

First we gave a presentation about engineering around natural disasters. Next we introduced the activity-building a structure of at least a certain height with an allotted amount of wooden blocks that can withstand an earthquake (which will be simulated with the shake of the table). If time permits, students will have to either increase the height of their structure or make it look better and still be able to stand.

Conclusion of the activity:

The building for this were all very similar, probably due to the fact that they were all using uniform wooden blocks and there were few solutions to this challenge with the given materials. It also went much quicker than anticipated due to the uniformity of materials, which allowed us time to clean up early and play a team building game.

Parts of activity that worked:

The kids got really excited when their structure withstood the shaking of the table. Some kids decided to just make a really tall and cool building instead, which they enjoyed. We did the human knot challenge after this, which they liked.

Parts of activity that did not work:

Several teams became frustrated when trying to think of how to build their structure, or if they did come up with an idea, they would become upset that another team was “copying” them.

LESSON PLAN WORKSHEET

Lesson Activity

Spaghetti Tower

Name:

Length of Activity:

40 min.

Supplies:

a box of uncooked spaghetti, small bag of jumbo marshmallows

Directions:

Present about teamwork in engineering, have them guess how many people worked on a great engineering feat. Then give each team a handful of spaghetti and one marshmallow and instruct them to create the tallest structure with the given materials. If teams are working well together, they will be awarded extra marshmallows or spaghetti.

Conclusion of the activity:

Many of the groups were able to construct some interesting designs given their fairly limited supplies. Most students attempted to just keep the jumbo marshmallow all in one piece while building their structure, which did not allow them to build anything very impressive. However, as time progressed, the students realized that they could break the marshmallow into smaller pieces in order to have more material to build with.

Parts of activity that worked:

The kids really enjoyed this project, as the materials used are fairly unorthodox. In addition, the students really learned the value of using the very last bit of every resource.

Parts of activity that did not work:

The jumbo marshmallow, while very fun to work with, created a rather annoying mess afterwards, especially once the kids realized it would be beneficial to tear the marshmallow into smaller pieces. Might be advantageous to have some type of paper for them to work on so the tables do not get messy.

LESSON PLAN WORKSHEET

Lesson Activity Name:	Heavy Lifting
Length of Activity:	40 min
Supplies:	painters tape, about 35 sheets of paper, several books (to provide weight)

Directions:

Begin by introducing electrical engineering. The activity is to produce a structure out of 5 sheets of paper and tape that must hold a certain amount of weight. The weight will continue to increase and students may have to make adjustments to their structure to adapt. Teams that are working well together can be awarded extra paper.

Conclusion of the activity:

All of the teams worked intently at their structures, determined to build the best structure that would be able to hold the most weight. After around 15 to 20 minutes of working, the students tested their designs by placing books on their structures to see if it could support the weight.

Parts of activity that worked:

The support tests on the groups' structures were very successful, as all of the kids really enjoyed seeing their structures support so much weight. In fact, many groups looked around the room for more books to put on their structures to see how much weight it could support.

Parts of activity that did not work:

Many students were able to finish this activity very quickly, and generally the kids begin to get restless if they have their project completed for so long. Perhaps have another activity planned along with this.

LESSON PLAN WORKSHEET

Lesson Activity Name:	Advanced Bridge Building
Length of Activity:	40 min
Supplies:	2 boxes of popsicle sticks, liquid glue, newspaper (to cover tables with)

Directions:

Begin by passing out sheets that explain the different types of bridges so the students learn about the types and are able to model their bridge after one of those pictured. (information below) Then instruct each team to create a bridge that stretches between two tables (about 1-1.5 feet) using popsicle sticks and glue. They can use as much as they want, but instruct them to use their resources wisely. Students will utilize all the skills they have learned thus far for this activity.

Conclusion of the activity:

Almost all groups were able to have some type of bridge-like structure completed by the end of the session. The activity took almost the entire length of the 40 minute period. Many students were able to test their bridge to see if it would be able to stretch along the span of two tables, and some students wanted to take their bridges home to continue working on them.

Parts of activity that worked:

This activity was much more hands-on, so many of the students were fully engaged with the activity and did not become distracted or finish the project terribly early. The students especially enjoyed working with glue.

Parts of activity that did not work:

Forty minutes may have actually been too little of a time period for this project, as many of the students will use a large amount of glue for their bridges. Waiting for the glue to dry was the trickiest part of this activity, since many of the students became frustrated when their bridges became extremely soggy and wouldn't dry.
